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On the Writer/Rider Distinction:

A Brief Experimental Study*

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A standard example of the ordering of phonological rules relates vowel lengthening, or a related diphthong quality change, to voicing of intervocalic t. These processes can be formulated roughly as:

(1) vowels become lengthened before voiced segments, and
(2) t, d → ɾ intervocalically after main stress.

The relationship between these two processes was first noted (as far as I am aware) in an article by Martin Joos (1942), "A phonological dilemma in Canadian English". Joos discussed two dialects which "divide into two groups according to their pronunciation of words like typewriter. Group A says [tɐIpɹɐIdɚ] while Group B says [tɐIpɹaIdɚ]...Group A distinguishes writer from rider, clouting from clouding, by the choice of diphthong alone...Group B has shifted the articulation of all vowels alike before the new /d/ from earlier /t/...from write to writer there is both the phonemic alternation from /t/ to /d/, and the phonetic alternation from [ɐI] to [aI]" (143).

Halle (1962) quoted Joos' article as data and interpreted the distinction as a difference in rule ordering: in dialect A, the vowel change rule precedes the voicing of the intervocalic consonant; in dialect B, the vowel change follows the consonant voicing rule. Chomsky (1962) uses a similar example of ordering in which the vowel difference is one of length rather than quality. He gives the forms (90):

decide	[dĭsa·yd]
decided	[dĭsa·yD̬d]
delight	[dĭlayt]
delighted	[dĭlayD̬d]

and the rules:

a → a· in the context: __ (Glide) Voiced
[t, d] → D in the context: Stressed vowel __ Unstressed vocalic.

In Chomsky's example the rules apply in the order given. Chomsky does not discuss the alternative merging order, since it is not the ordering of rules which is at issue in this article, but rather the nonlinear relation between the phonemic (/ayd/ vs. /ayt/) and the

phonetic ([a·yD] vs. [ayD]) levels.

The example appears again in The Sound Pattern of English, where Chomsky and Halle (1968) cite Joos and give the rules (342):

Diphthong Laxing - $ay \rightarrow \Lambda y$ / __ [-voice]

and

t-voicing - $t \rightarrow$ [+voice] / V __ V,

noting that dialects differ by the ordering of the two.

Sanford Schane also refers to this ordering difference in Generative Phonology (1972:85-6), giving two rules "found in English":

$$V \rightarrow [+long] \; / \; \_\_ \; [\overset{C}{}_{+voiced}]$$

$$\begin{matrix} t \\ d \end{matrix} \rightarrow D \; / \; V \; \_\_ \; [\overset{V}{}_{-stress}]$$

Schane gives write/ride, and writer/rider as his examples.

The writer/rider distinction is also referred to in an exchange between Chomsky and Halle and Fred W. Householder in Journal of Linguistics (1965). Here, the question of whether the distinction is one of quality or length is mentioned. Joos had spoken only of a quality difference (aI vs. ɐI); other writers have regarded the difference as one of length (a·y vs. ay). As Chomsky and Halle note here (133, no. 3), both distinctions have been reported by Kurath and McDavid (1961, maps 26-7). Kurath and McDavid's distinction between "fast" and "slow" diphthongs depends on the duration of the initial element, but this difference may result in a quality difference. They note that slow diphthongs predominate before voiced consonants in most of the South and South Midland (109-10):

> ...we find more or less marked positional allophones before voiceless and voiced consonants, as in twice vs. five: [aɪ] ~ [a·ɛ] in West Virginia, [ɐɪ] ~ [a·ɛ] in Virginia, [aɪ] ~ [a·ɐ, a·ɛ] in most of South Carolina and Georgia, and [ɐɪ ~ ɑ·ɪ] in coastal South Carolina and along the coast of Georgia and Florida.

Because this particular dialect difference has been cited so frequently in duscussions of rule ordering, a topic of general theoretical interest, this experiment was designed to determine whether or not speakers actually do produce and perceive a linguistically significant difference in vowel length or quality in pairs like writer and rider, as Joos and others have claimed.

Experiment Design

The design of the experiment was as follows. Two informants were selected: one, RW, maintained that he did not have the distinction in question--that for him, pairs like writer/rider, or latter/ladder, were homophonous; the other, AMZ, maintained that he did produce and hear the distinction, at least at certain rates of speech, or in certain styles.

Three minimal pairs were selected: writer/rider (the "classic" example, with a diphthongal stressed vowel and merging intervocalic consonants), latter/ladder (a pair with a non-diphthongal stressed vowel and merging intervocalic consonants), and rapid/rabid (a control pair, in which the consonant voicing distinction is not neutralized).

In order to determine if the distinction occurred in running speech (as opposed to minimal pairs or word-list reading), six sentences were constructed, each using one of the six forms. The sentences were of approximately equal length and were constructed so that the members of each minimal pair appeared in metrically similar environments and did not appear at the ends of the sentences. Three dummy sentences were added to the list in first, last, and middle position to avoid irregularities caused by the positions of the sentences in the list.

The informants, without being informed of the purpose of the experiment, were asked to read the nine sentences "in an ordinary voice, at normal speed". The sentences were recorded in an anechoic chamber, on a Tandberg tape recorder, at 7 1/2 ips. Each informant read the sentences twice.

The six forms to be tested (twelve tokens for each speaker--24 in all) were then extracted from the tape and spliced into blank tape at five-second intervals. The order of the forms was randomized for each speaker, except that no two members of a minimal pair were allowed to appear consecutively. This tape was then duplicated, re-randomized for each speaker, and added to the original tape so that two instances of each production appeared on the finished tape. Thus, 48 forms appeared on the tape (12 tokens for each of two speakers, each token played twice). Two dummy forms were added so that the respondents could get started (these responses were discarded), making 50 required responses. Directions for responding were recorded at the beginning of the tape.

An answer sheet was constructed. Directions identical to those on the tape appeared at the top, and fifty numbered minimal pairs followed. The respondents were instructed to mark the member of the minimal pair that they heard for each utterance on the tape, choosing one member of each pair for each utterance even if they had to guess. A data sheet was attached to each answer sheet requesting the respondent's name, native language, place of birth, home city before starting school, and cities of elementary, junior high, and high schools.

There were two groups of respondents: one consisted of 48 undergraduate students who were given the listening test under classroom conditions, the other, 13 linguists and linguistics graduate students who took the test individually or in groups of two or three. The two informants are included in the latter group. All participants were native speakers of American English.

Results and Interpretation

The principal results of the experiment are presented here in the form of tables. These are attached.

The subjects seemed to be able to distinguish rapid and rabid with little difficulty (close to 90% correct answers) except for a problem with one item, which I will discuss shortly. The percentage of correct answers for the latter/ladder pair is close to 50%, which suggests that the subjects could not distinguish between these two items since a 50% correct score could as well have been achieved by guessing. The percentage of correct identifications for the writer/rider pair was somewhat higher--about 60%. (See Table VIII.)

Spectrograms and oscillograms were made of each of the 24 tokens in order to determine, if possible, what cues the respondents used in identifying the items.

Preceding-vowel length has been shown to be an important cue in the perception of the voiced-voiceless distinction for English consonants, and the identifications of rapid and rabid seem to confirm this. The RW rapid and rabid tokens were identified with 92% accuracy. Both rapid tokens had shorter vowels than the rabid tokens, but voicing of the intervocalic consonant must also have been a cue, since the longer rapid vowel was only 10 msec. shorter than that of the shorter rabid.

The AMZ rapid tokens were identified with 95% accuracy, but the AMZ rabids were identified correctly only 41% of the time even though the spectrograms indicate some voicing of the b. The length of the longer vowel of rabid, token A2, however, is only 10 msec. longer than the 110-msec. æ's of the rapid tokens, and the length of the shorter æ (rabid, token A1) is shorter than either of the æ's in the rapid tokens. Apparently, the failure of the informant to produce a vowel-length difference conflicted with the voicing cue and caused the respondents' confusion about AMZ's rabids.

The small differences in vowel length and intervocalic consonant length in the latter/ladder pair appear not to have been usable as cues. Responses to the AMZ tokens were essentially random. Responses to the RW tokens show some tendency to identify the items as ladder. There is a 72% correct score for ladder, but there is only a 31% correct score for latter. This may be related to the considerable length of the æ vowels in all of the RW latter and ladder tokens, which, coupled with the voicing of the intervocalic consonant, might favor the interpretation of this consonant as d rather than t. The fact that most of the intervocalic consonants in this group were over 20 msec. (the standard flap length) long does not seem to be significant, since the same consonant lengths did not produce this favoring of ladder in the tokens from AMZ, the other informant.

Vowel quality did not appear to be used as a cue in either the rapid/rabid or the latter/ladder sets of identifications.

As noted above, the respondents did a little better at identifying writer and rider than latter and ladder. The intervocalic consonant lengths show no pattern interpretable as a cue. The vowel lengths show no pattern for RW, but for AMZ they appear to be somewhat shorter before the underlying voiceless consonants (writer: 130 and 105 msec., vs. rider: 155 and 160 msec.). These small vowel-length differences do not seem to be perceptually significant, however: although AMZ produced small differences and RW did not, the percentages of correct scores for this pair were nearly the same for both informants (60% for RW, 61% for AMZ).[1]

Since the original dialect difference noted by Joos was reported as a vowel quality distinction--ɐi vs. ai--rather than a length distinction in writer/rider, vowel quality was examined as a source of the slightly higher distinguishability of writer/rider as opposed to latter/ladder.

As chart V indicates, RW produced no consistent difference between the diphthongs of writer and rider. Chart VI shows, however, that the diphthongs of AMZ's writer and rider were clearly different from each other; both the nucleus and the glide of the writer diphthong were higher than those of the rider diphthong. (The nuclei showed an F_1 difference of at least 200 Hz.) As with the length differences, however, the respondents did not seem to use this difference, since scores for the productions of both informants were nearly the same.

Since a writer/rider distinction was produced by one informant (at least for the four tokens used in this test), one would expect that at least this informant would be able to identify his own productions correctly. The responses marked on Table IX, however, show that AMZ was not able to distinguish his own productions with better-than-average accuracy.

It is possible, of course, that the number of tokens in question--two items, two tokens each--is too small to establish that AMZ makes the vowel quality distinction consistently, and it is also possible that his identification errors are due to some outside factor. But, as the data stands, it looks as if he produces the distinction but does not perceive it.

Most of the respondents, who apparently hear no distinction between latter and ladder or writer and rider, were Ohioans--as was RW, the informant who made no distinction. For these listeners (as for RW), the writer/rider distinction does not exist; judging from their scores, they appear to have had to guess at the identifications.

(An interesting indication that the linguists had to guess more often than the undergraduate is their low stability of response: The average difference in the number of correct answers for two identical tokens was 39% for the linguists, as opposed to only 9% for the undergraduates. Since the linguists took the test under better hearing conditions, this is an unexpected result; I have no idea why their responses were so unstable.)

It happened that one of the students, DS, was a native of Toronto, Ontario. It was in Toronto that Joos first noted the vowel distinction between writer and rider (in the dialect he called Group A). The responses of DS were examined to determine whether he was able to recognize the distinction that AMZ had produced. It is probable that he did. On the test, this respondent made four errors in identifying rapid/rabid, four in latter/ladder, and four in writer/rider. But two of his errors on writer/rider were due to his identification of rider, token R2, as writer, and if DS was using vowel quality as a cue, this would be an expected error, since the F_1 of the R2 rider nucleus is only 450 Hz, making this vowel nucleus non-low and therefore identifiable as the vowel of writer. The remaining two writer/rider errors that DS made, in 16 identifications

for this pair, could be due to chance or to simple mis-hearing, since they amount to fewer mistakes than he made for the uncontroversial control pair, rapid/rabid.

The two respondents who were from the San Diego, California area (one was a linguist; one, a student) gave similar indication that they perceived a writer/rider distinction: LS and JE each had five writer/rider errors, but both identified the R2 rider as writer, which leaves only three errors unaccounted for. LS made two rapid/rabid errors; JE also made two.

Examination of the responses of individual Ohioans (and of those of the few respondents from other areas--New York, New Jersey, Louisiana, Arkansas, Indiana, and Iowa) yielded no similar results among the students, although a few of the linguists did quite well. Apparently, most of the speakers in this sample merge latter/ladder and writer/rider--and, one would expect, all similar pairs. This fact, of course, does not indicate that no dialects exist which maintain a distinction. It does show that the respondents in this sample were speakers of dialects which have, in Chomsky and Halle's terms, the merging order of the two rules in question, t-voicing and lengthening (or Diphthong-Laxing).

Thus, the responses fail to support the claim that a length distinction remains in voiced-voiceless pairs when the consonant distinction is neutralized, since the participants failed to distinguish latter and ladder. And since most of the respondents failed to perceive the distinction produced by one of the informants, the generalized results also fail to support the claim that a quality distinction is maintained between the diphthongal nuclei of such pairs. Because of its limited scale, however, the experiment only fails to support--but cannot actually falsify--such a claim, because dialects may well exist in which the distinction is maintained. Some evidence that Joos correctly described such a dialect, and that other such dialects may exist, was found in the sample.

The problem posed by the failure of an informant to perceive a distinction which he himself produced and which was apparently large enough to be perceptible (AMZ's failure to discriminate effectively between his own writer and rider productions) certainly deserves further study. Reports of other instances of this kind should be reviewed, and further experiments might be conducted in order to examine this problem, since the solution could shed light on such varied topics as the relation of production to perception, the kinds of conclusions to be drawn from listening tests, aspects of test design, and the nature of phonetic and phonological representations.

Footnotes

*This paper was written for a phonetics course taught by Prof. Ilse Lehiste in Winter Quarter 1973. I would like to thank Prof. Lehiste for her guidance.

1. D. R. Sheldon (1973) has published the results of an experiment involving forced-choice identification of the American pronunciation of writer and rider. His data fail to support the view that first-vowel durations are a primary cue for discrimination in this pair.

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TABLE I

Number of correct answers for each token: undergraduate students, 48 respondents. 48 responses for each instance, total of 96 for each token.

Instance	token	rapid	rabid	latter	ladder	writer	rider
1		46	36	22	36	35	22
2	R1	48	41	8	39	34	25
total		94	77	30	75	69	47
1		45	46	22	30	37	20
2	R2	44	46	7	34	36	19
total		89	92	29	64	73	39
1		46	32	23	22	35	23
2	A1	44	8	21	26	38	27
total		90	40	44	48	73	50
1		46	25	23	22	38	10
2	A2	47	13	28	29	38	24
total		93	38	51	51	76	34

TABLE II

Percentage of answers correct for each instance and token. (Same data as Table I, in percentages)

instance	token	rapid	rabid	latter	ladder	writer	rider
1		96	75	46	75	73	46
2	R1	100	85	17	81	71	52
total		98	80	31	78	72	49
1		94	96	46	63	77	42
2	R2	92	96	15	71	75	36
total		93	96	30	67	76	39
1		96	67	48	46	73	48
2	A1	92	17	44	54	79	56
total		94	42	46	50	76	52
1		96	52	48	46	79	21
2	A2	98	27	58	60	79	50
total		97	40	53	53	79	36

TABLE III

Number of correct answers for each token: linguists, 13 respondents. 13 responses for each instance, total of 26 for each token.

Instance	token	rapid	rabid	latter	ladder	writer	rider
1		13	12	2	10	10	5
2	R1	13	12	0	12	11	10
total		26	24	2	22	21	15
1		13	13	3	5	11	2
2	R2	13	13	1	11	6	4
total		26	26	4	16	17	6
1		13	12	9	5	10	9
2	A1	13	0	3	6	8	11
total		26	12	12	11	18	18
1		13	6	6	7	11	4
2	A2	13	6	8	8	7	9
total		26	12	14	15	18	12

TABLE IV

Percentage of ans ers correct for each answer and token. (Same data as Table III, in percentages)

Instance	token	rapid	rabid	latter	ladder	writer	rider
1		100	92	15	76	76	38
2	R1	100	92	0	92	85	76
total		100	92	8	84	81	57
1		100	100	23	38	85	15
2	R2	100	100	8	85	46	31
total		100	100	16	62	66	23
1		100	92	69	38	76	69
2	A1	100	0	23	46	62	85
total		100	46	46	42	69	77
1		100	46	46	54	85	31
2	A2	100	46	62	62	54	69
total		100	46	54	58	70	50

TABLE V

Number of correct answers for each item or form: there were 244 responses to each item for each informant; 488 responses to each item, total.

	rapid	rabid	latter	ladder	writer	rider
RW	235	219	65	177	180	107
AMZ	235	102	121	125	185	114
total	470	321	186	302	365	221

TABLE VI

Percentage of correct answers for each item. (Same data as Table V, in percentages)

	rapid	rabid	latter	ladder	writer	rider
RW	96	90	27	73	74	41
AMZ	96	42	50	51	76	46
total	96	66	38	62	75	44

TABLE VII

Number of correct answers for each voiced-voiceless pair: there were 488 responses to each pair for each informant; 976 responses to each pair, total.

	rapid/rabid	latter/ladder	writer/rider
RW	454	242	287
AMZ	337	246	299
total	791	488	586

TABLE VIII

Percentage of correct answers for each voiced-voiceless pair.
(Same data as Table VII, in percentages).

	rapid/rabid	latter/ladder	writer/rider
RW	93	50	49
AMZ	69	50	61
total	81	50	60

TABLE IX

Informants' responses: Correct responses are listed here for each token. Since two instances of each token were played, the highest possible score is two. Percentages correct are given for each pair.

token	rapid	rabid	latter	ladder	writer	rider
RW's answers:						
R1	2	1	0	2	2	1
R2	2	2	0	1	2	0
% correct	88		38		63	
A1	2	2	1	0	1	1
A2	2	0	1	0	2	0
% correct	75		25		50	
AMZ's answers:						
R1	2	2	0	2	2	1
R2	2	2	1	1	1	0
% correct	100		50		50	
A1	2	2	1	0	2	2
A2	2	2	2	2	0	1
% correct	100		63		63	

TABLE X

Length of stressed vowel and length of intervocalic consonant (in msec.) for each token.

		rapid	rabid	latter	ladder	writer	rider
R1	$\acute{V}$	100	130	175	190	140	190
	C	75	70	30	30	30	30
R2	$\acute{V}$	120	150	160	170	160	145
	C	80	50	30	20	30	25
A1	$\acute{V}$	110	90	110	115	130	155
	C	75	65	30	25	20	30
A2	$\acute{V}$	110	120	100	115	105	160
	C	65	60	30	20	35	30

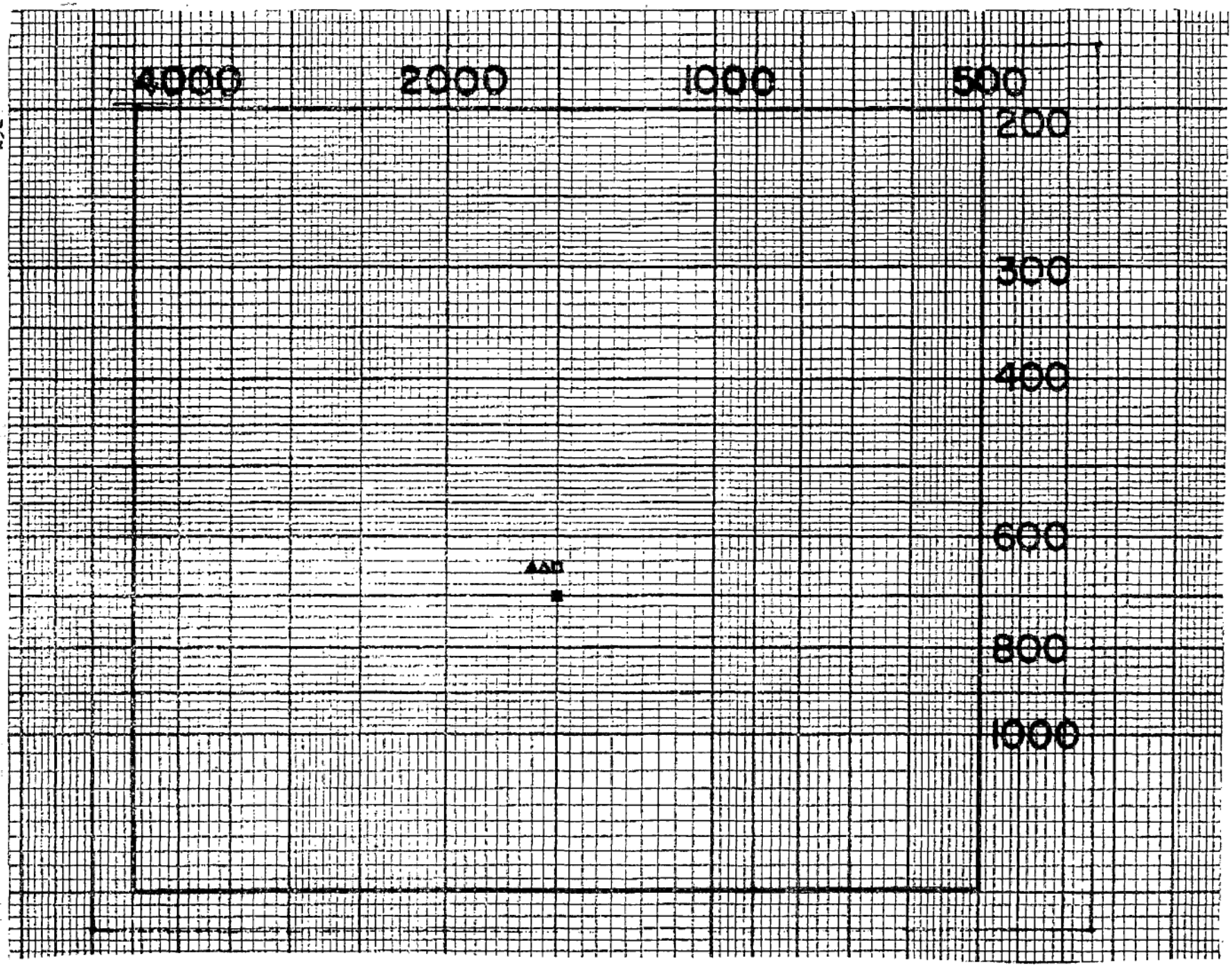
TABLE XI

Vowel quality of stressed vowels of each token (first and second formants, in Hz). The extreme point of the glide is included for diphthongs.

		rapid	rabid	latter	ladder	writer	rider
R1	F_1	650	650	600	650	500- 500	650- 500
	F_2	1550	1500	1550	1450	1350-1600	1200-1700
R2	F_1	650	700	650	650	600- 600	450- 500
	F_2	1600	1500	1500	1400	1200-1800	1200-1750
A1	F_1	750	700	700	800	650- 450	850- 600
	F_2	1500	1350	1400	1400	1000-1700	1000-1650
A2	F_1	650	750	750	800	600- 500	850- 600
	F_2	1300	1400	1350	1400	1200-1600	1100-1550

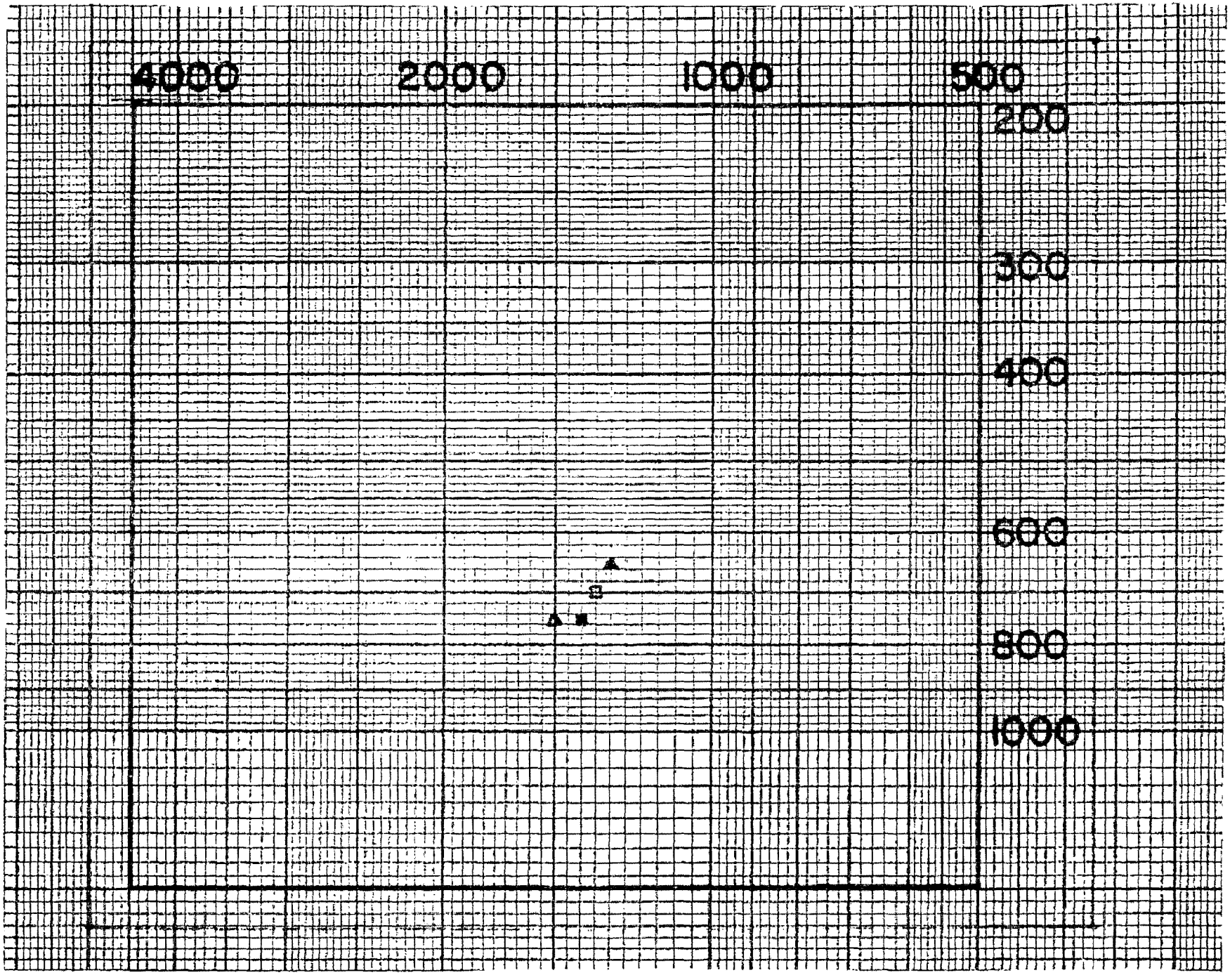
RW rapid R1 △ rabid R1 □
rapid R2 ▲ rabid R2 ■

CHART I



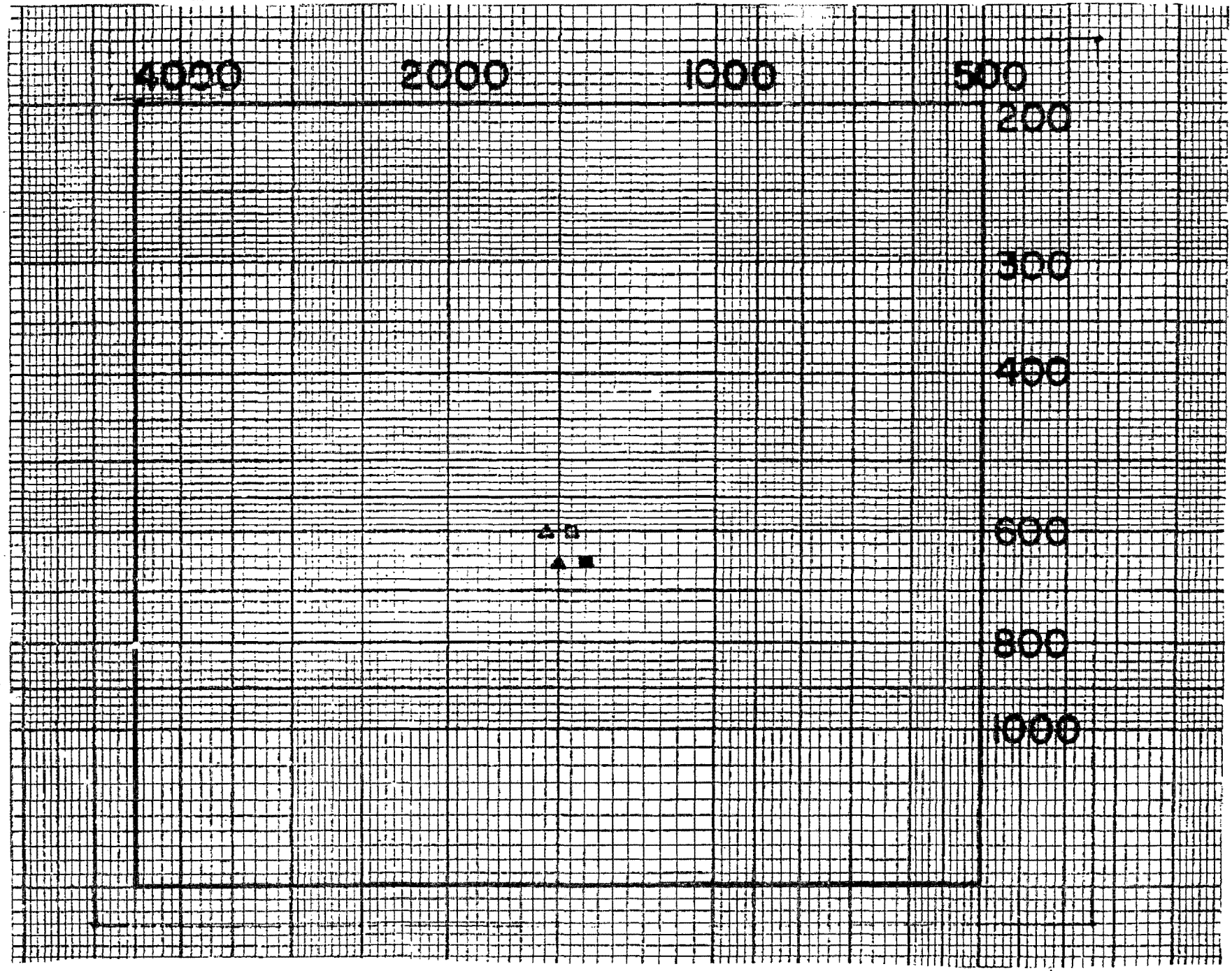
AMZ rapid A1 △ rabid A1 ▬
rapid A2 ▲ rabid A2 ■

CHART II



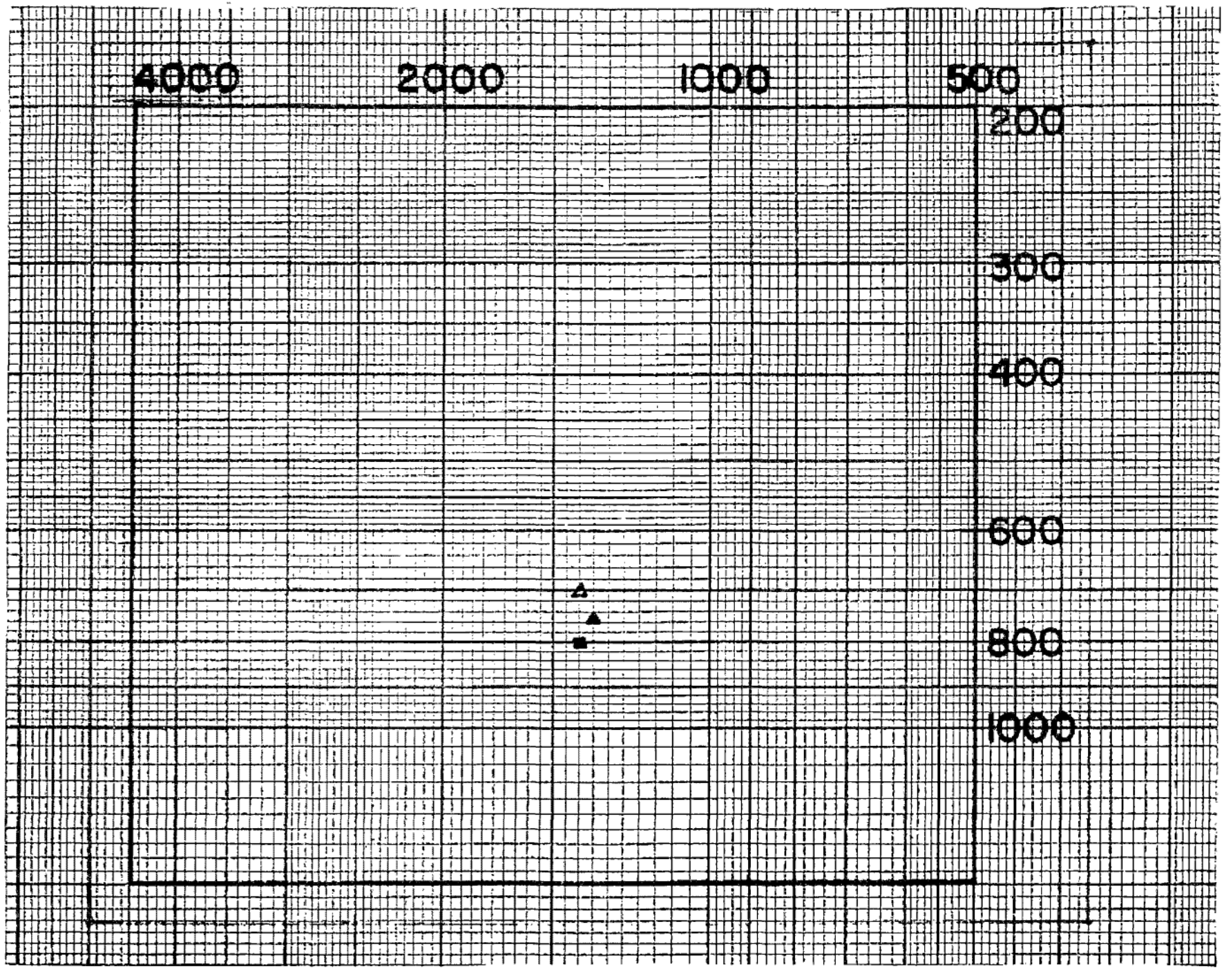
RW latter R1 △ ladder R1 □
latter R2 ▲ ladder R2 ■

CHART III



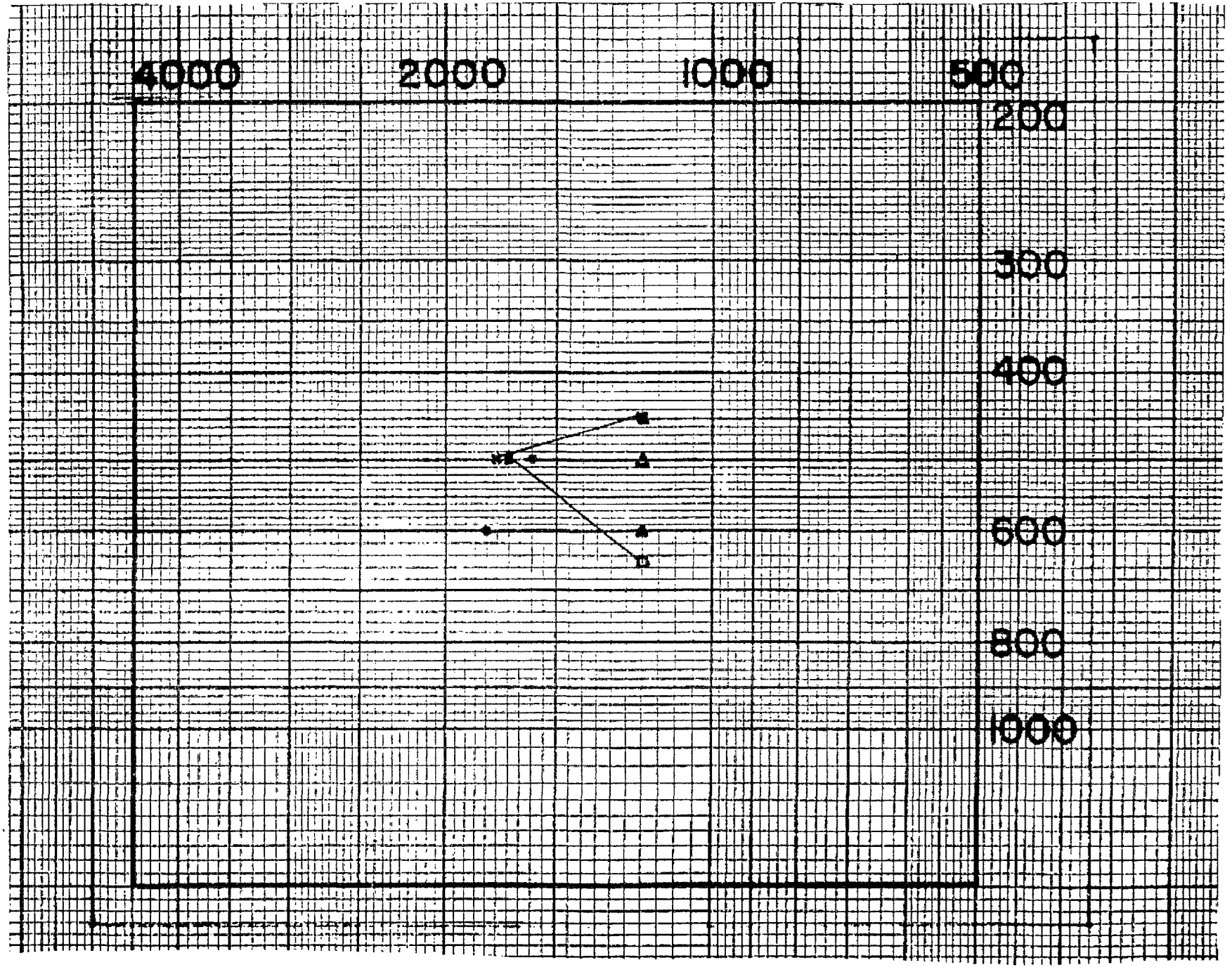
AMZ latter A1 △ ladder A1 ▬
latter A2 ▲ ladder A2 ■

CHART IV



RW writer R1 rider R1
writer R2 rider R2

CHART V



AMZ writer A1 rider A1

writer A2 rider A2

CHART VI